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ABSTRACT

The potential of using the Apple II+ microcomputer with an ALF products music software system (nine voice) for computer-assisted instruction in composition was examined. Two boys, 8 and 10 years of age, served as subjects. Naturalistic observations were made as the children participated in a 10-session program that consisted of composition activities, such as adding harmony and writing rounds, and related activities, including listening tasks. Most of the composition activities, particularly the round or canon, were found to be useful vehicles for teaching both composition and other topics, such as music fundamentals. There were some differences in the nature of the subjects' compositions and in their approaches to the tasks. Although one subject preferred a traditional orientation to the ALF program and the other had less conservative musical preferences, the program accommodated these individual differences. Moreover, the interest displayed by both subjects extended beyond the instructional sessions. Teacher characteristics, such as teaching skills and musical background, were found to be of critical importance for the success or failure of the microcomputer-based approach to music instruction. It was concluded that the ALF music system could be used to advantage on an individual basis in initiating interest in composition. Limitations of the program and the system are pointed out. (Author/RH)

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A Computer-Assisted Instruction Approach to Music for Junior-Age Children: Using ALF for Teaching Music Composition

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April, 1982

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Using microcomputers for teaching various aspects of music is a relatively new area of development in computer-assisted music instruction. While large computers have been used for teaching a number of specific aspects of music such as interval recognition and rhythm exercises, the use of micros, especially for young children, offers novel and promising advantages over the computer-assisted instruction which requires larger hardware facilities.

Since the late 1960's computers have been used to teach many aspects of musical knowledge and performance. Much of the early work was in the areas of ear-training, sight-reading and rhythm. For instance, the PLATO system, comprised of a central computer linked to terminals with keyboards and videoscreens by telephone, has been used for teaching rhythm perception (Placek, cited in Watanabe, 1980). College students were required to identify time signatures, represent rhythms and indicate which of several rhythm patterns had been presented. The same system has also been used for such tasks as interval recognition (Hair, 1977), a variety of pitch exercises (cf. Watanabe, 1980) and for music dictation (Newcomb, 1980). Computers have also been used for studying instrumental performance. For instance, at Pennsylvania State University, Diehl (1972) used an IBM 1500 computer for teaching articulation, phrasing and rhythm for clarinet. Not surprisingly, computers have not been used to the same degree for teaching such aspects of music like composition or music appreciation - difficult teaching topics to pursue with or without the computer aid. Perhaps the most promising advances in this direction have been offered recently through the use of microcomputers. In particular, the work with LOGO music pursued by Bamberger (1972, 1973, 1974, 1975) and Beckwith (1975) offers many attractive possibilities. By using a series of musical games or exercises which require the active participation of the student, Bamberger and Beckwith have

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attempted to create a setting where students may explore the various dimensions of musical sounds. Recently, Lamb (1981) has developed similar games to those of Bamberger, with a colorful and highly informative visual display. These games invite the child to explore various musical dimensions. For instance, there is a game titled "Timbre Painting" which allows the child to experiment with different timbres by painting the corresponding colours on the musical score. Lamb's Musicland games are currently delivered on a PDP 11/45, but are being adapted for a microcomputer.

There are other potential benefits of a microcomputer approach to certain aspects of music instruction. For one, microcomputers are accessible to students and teachers, as more and more schools and private individuals are investing in microcomputers of one sort or another. As well, the possibility of stressing previously neglected topics in the music curriculum, such as composition, may well be done through the use of appropriate computer-assisted instruction. Computers also offer the features of immaculate record-keeping and immediate aural feedback.

A music software system (nine voice) distributed by ALF Products in Denver, Colorado for the APPLE microcomputers is one system which can be used for teaching aspects of the music fundamentals and composition. The ALF music system, however, has been primarily categorized as a music editor, rather than as an educational device. Nevertheless, it has been used in educational contexts, such as for teaching computer and music literacy. The undertaking of the present research was to assess the feasibility of using the ALF system as an aid for teaching composition at the Junior (Grades 4 - 6) level.

Method

Subjects

Two boys, aged 8 and 10 years, served as subjects. Subject 1, the younger child, had some private musical training in piano and voice. In addition, music was given high priority in the home, as all family members are involved in musical activities of various types. Classical music in particular was stressed. Subject 2 had very little prior individual music instruction. As well, music did not play as

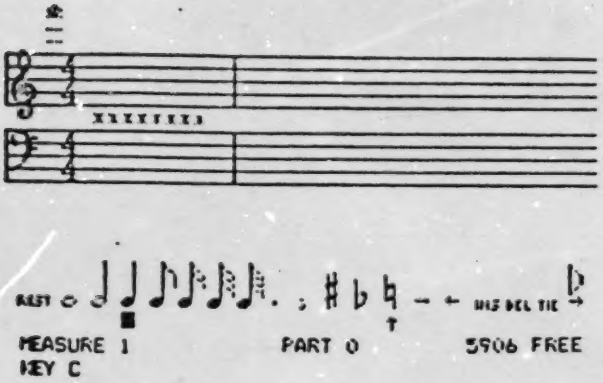
important a role in the home for Subject 2 as for Subject 1. While the parents of Subject 2 enjoy music, their encouragement to the children for pursuing musical endeavors was not as directed as in Subject 1's family situation. Much of the music in Subject 2's home was contemporary, due to the presence of older teen-age siblings.

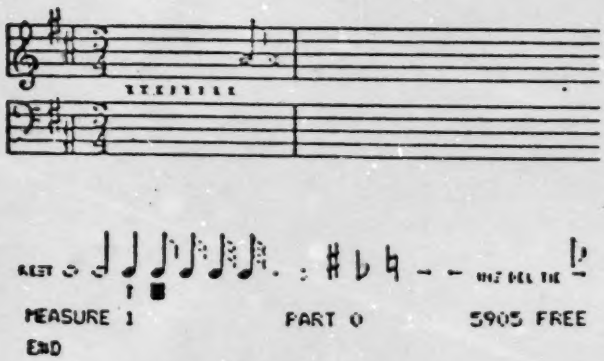
Apparatus

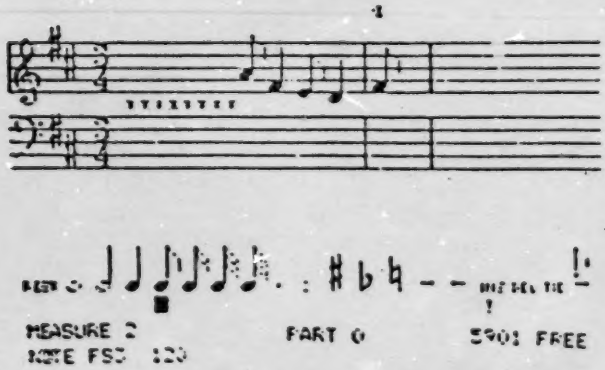
An APPLE II+ microcomputer with an ALF card, games paddles and colour monitor, an amplifier and the ALF music disk were used.

Using the two main programs of the ALF editor, PLAY and ENTRY, music can be played on the synthesizer or composed using the APPLE keyboard and games paddles. When music is played, a multi-coloured display depicting the voices, pitch and duration of the notes is shown on the colour monitor. The ENTRY program permits the user to write virtually any type of music using traditional symbols and notation. Some of the fundamentals such as time and key signatures are entered by typing the appropriate commands on the keyboard. Others, such as pitch and duration, are achieved by manipulating the game paddles. As well, subroutines may be written, saved and called, to facilitate the writing of music where passages are repeated at several points throughout the composition. In all cases, the music itself or commands related to tempo or dynamics come in view on the monitor as they are entered, or information may be called to the screen if it is not within the immediate workspace. As well, while in the ENTRY mode, the music that has been written may be played back at any time so a composition may be reviewed as it is being written. Similarly, a composition may be edited at any time, while in the ENTRY mode. There is provision for changing the type of sounds produced, so as to approximate different instrumental sounds, and to alter the dynamics. As well, nontraditional symbols for uncommon note durations may be employed through the use of a free format mode. Compositions may be saved on the disk, and once saved, may be played using the PLAY program, or examined and/or edited using the ENTRY program. In addition, six contrasting compositions are included with the software. These compositions highlight many of the features of the ALF Music System. Some examples of the visual display for the entry program appear in Figure 1.

Figure Caption

Figure 1. The ALF Entry Display

Appearance of display before any notes or commands have been entered. "KEY C" in bottom left corner indicates position of cursor. Asterisks are for setting tempo, volume, envelopes, etc. "5906 FREE" indicates space in memory. "PART 0" indicates voice on display (parts number- 0 - 8).



Key signature, time signature and one note have been entered. Arrow under the menu has been positioned for the next note duration. Before entering the next note, the user will press a button on the menu paddle to cause the small block to move under the quarter note, where the arrow is set.

Four more notes have been entered. Cursor has been moved back to the last note, and the user has positioned the menu arrow so that a note may be inserted where the cursor appears. "FS3" indicates the position of the F♯, "120" indicates the value (240= quarter)

Each session was recorded using a tape recorder. All of the ALF music used for demonstration purposes as well as that composed by the subjects was saved on a disk. A record player was also used in a few of the sessions. Chalkboard, pencil and paper, and a reference card with some of the most commonly used ALF commands were always readily available to the subjects.

Procedure

A 10-session program for individual subjects was designed. Each session was expected to run for 60 - 90 minutes, determined in part by the student himself. For every session, some particular tasks, all of which are described herein, were planned.

If a subject indicated a strong preference for one type of activity over another, the session was modified according to the expressed interest.

The first session was intended largely as a familiarization session for the subject and for some of his friends and members of his family. Besides familiarizing the subject and his family and friends with the system, it was planned that the subject would be the primary participant in writing a "random song" (a composition of several parts, written using arbitrary pitches and durations) during the first session.

For the next few sessions, up to a second "family and friends" session, most of the specific composition and related activities were introduced.

A second family and friends session was planned for the sixth session. It was expected that the subjects would be familiar enough with the system at this point to be able to lead the session. It was hoped that the subjects would be able to show the other participant how to operate the two major programs, PLAY and ENTRY, and further, to encourage their family and friends to do some of their own composing. It was intended that the instructor would leave the room for most of this session, so as to allow the subject to direct the session without influence from the instructor.

The last sessions were planned for continuing the ALF and music activities described herein. The activities for the final session were chosen by the subject.

Composing Activities

Random Music

The first writing task required the subjects to write arbitrary or random music, where no restrictions were placed on the types of notes used, nor on the relationships between the notes. Since the random music is simple to compose, and can be written in a relatively short period of time, such an exercise was expected to accomplish at least four aims. Firstly, it was felt that the subject would rapidly become familiar with the mechanical features of the ENTRY system. Secondly, it was hoped that subjects would experiment with the dimensions of the traditional music notation system, eg. regarding the sound of the highest and lowest, fastest and slowest notes. Thirdly, perhaps primarily because of the novelty of the medium, it was hoped that some of the preconceived notions of music would be questioned by the participants, so as to broaden their views as to the possible forms of "music". Finally, the subjects would gain the satisfaction of having completed a "composition" during their first session.

Known Song

The next writing activity planned in the program sequence was that of writing a "known song". Subjects were asked to think of a tune that they were familiar enough with to enter, by ear, on the ALF system. Several outcomes were anticipated from this activity. For one, the subjects would probably become more familiar with the type of sound emitted by the synthesizer, as compared to the way in which they were accustomed to hearing it or performing it themselves. As well, it was expected that the relationships between different note durations and the importance of note durations would be exemplified by such an exercise.

Round

It was planned that the subjects would learn how to write rounds in the early sessions, beginning with rounds that are familiar to most children, such as Row, Row, Row Your Boat and Frere Jacques. The use of this form was expected to yield several advantages. Rounds could be used to introduce principles of harmony, illustrate part singing or part performance, or simply to create a full and pleasing work using a

simple theme. It was hoped that the latter result would serve to encourage the composition of other forms of music, where the writing process would be necessarily more complex. As well, the round is a convenient form for introducing some of the features of the ALF system, such as the subroutine and transposition functions.

Adding Harmony

Adding a harmony line to a given melody line was the next writing activity planned in the sequence. Since it was expected that the subjects would already have acquired some elementary notions of harmony while writing the rounds, the previous writing would serve useful as a starting point for introducing other chords. It was anticipated that the sub-dominant (IV) and dominant (V) chords, in addition to the tonic chord (I), would be the principal chords discussed by the instructor and used by the subjects. In instances where it seemed appropriate, other related concepts would be introduced, such as the behaviour of leading notes in traditional music.

Variations on a Theme

Creating variations on a given a melody line was another activity planned for the subjects. By introducing this form of composition, it was expected that the subjects would gain a fuller understanding of the types of manipulations that can be made to a theme to produce a musical work. Subjects would be given instruction regarding the types of transformations that they could employ.

Open

The final writing activity was less structured than the others. The open exercise was simply to write a composition of any style, length or form that the subject desired. As for the other activities, no time restrictions were imposed.

Related Activities

Non-writing activities were planned for various points during the program. Unlike the composition activities, where one activity builds on the last, these activities can be regarded as largely independent in nature. Two related activities are described below.

Listening

Subjects were asked to listen to recordings of instrumental

music. Selections included orchestral and piano excerpts from the baroque and classical periods as well as jazz piano. It was expected that most of the music would not be familiar to the subjects, with the exception of a recording of Symphony #94 (The Surprise Symphony) by Haydn. The same movement has been transcribed for the ALF music system, and thus, the subjects would have been exposed to it through ALF.

In all cases it was planned that some general questions regarding the music would be asked. For instance, subjects would be asked if they enjoyed the work, and what kind of a mood the work seemed to portray. In some cases, more specific questions regarding the structure were planned.

Tune Blocks

The tune block exercise was adapted for ALF on the basis of a similar exercise created for the LOGO music system (Bamberger, 1974b, 1979). The task requires a subject to manipulate a series of short musical passages, one to five notes in length, so as to put the passages or blocks into a coherent musical sequences, as judged by the subject. By utilizing the subroutine feature of the ALF system, a similar system to the LOGO tune block system was created. The tune blocks exercise was invented to make students become aware of the hierarchical structure of melodies, what features discriminate different blocks, and what the effects of context have on the interpretation of a particular block (Bamberger, 1974a, 1979). In short, manipulating tune blocks allows the student to "actively [take] apart and [put] together a coherent musical structure" (Bamberger, 1979, p. 2).

The types of strategies used to manipulate the tune blocks include transposition, inversion and the like (Bamberger, 1974a, 1979). As well, Bamberger (1979) notes that students may classify blocks as beginnings, middles or endings, building up bigger chunks from the blocks before deciding on the musical whole, rather than simply choosing a block to begin with and then adding blocks to the sequence.

Data Collection

A naturalistic approach was taken to study the subjects'

responses over the course of the sessions. Subjects were observed as they interacted with the ALF system and program as previously described. Subjects' verbal responses from each of the sessions were recorded and transcribed. These were examined along with their compositions and results on the related musical tasks. Also in accordance with the naturalistic approach, the parents of both subjects were asked to keep a record of comments or incidents that occurred outside the ALF sessions that they felt were related to their children's exposure to the ALF program.

Results

The results obtained from the present research can be described and analyzed from at least two viewpoints. On the one hand, the apparent advantages and limitations of using the ALF system and program as aids for teaching music to junior-age children can be assessed. On the other hand, the particular types of responses and experiences of the subjects themselves are worthy of consideration as they stand on their own. The information yielded from both of these directions will be examined.

The ALF System and Instructional Program

Overview. There were several areas of music study which appeared to be well-suited for the ALF system in the context of the instructional program as described. Perhaps the most obvious effects occurred with respect to the learning of music theory, fundamental principles of harmony, and enjoyment in composition. Less obvious, but of equal if not greater importance, was the apparent impact of the prog am on the subjects' general understanding and pleasure of music. These effects are discussed under the section on active participation. The results lending support to each of these observations will be examined in turn.

Music Theory. Although it was not intended that music theory be taught specifically, there were numerous instances where the subjects acquired knowledge with respect to traditional music notation and symbols, due to their felt need for this type of information when writing music. The learning of note names and note durations became evident as the sessions progressed. Often note names and durations were learned as a result of the subject's own deductions, particularly

for Subject 2, as his knowledge of music theory was almost non-existent at the beginning of the sessions.

When Subject 2 began the program, he had some relative ideas about note duration relationships, and was able to estimate the length of durations near the end of the first session:

M. Those are faster, right...fast, faster and those are fastest.

...

M. So this way, if I put in four of those, (quarter notes) I'll have a bar, right?

R. Yeah.

M. And only two of those? (half notes)

R. That's right.

M. Does it take six of those? (eighth notes)

R. No, eight, and sixteen of those. (sixteenth notes)

M. Oh, I get it, and thirty-two of those. (thirty-second notes)

Session 1, Subject 2

As the sessions progressed, Subject 2 began using appropriate labels for note durations, and developed a more absolute sense of their value:

R. Do you want to hear it again?

M. Yeah...no, no hold it. I want to...how about a rest, no a whole note on that part?

Session 4, Subject 2

M. How many (quarter notes) in a bar?

R. What's the time signature?

M. There's four...I want to make it three.

Session 5, Subject 2

M. How can I have a fast whole?

R. You'd have to use a shorter note, I think.

M. O.K., I'll use half notes.

Session 8, Subject 2

A similar pattern emerged with respect to note names, where Subject 2 first became aware of relative relationships (high versus low notes and their approximate positions on the staff), before learning the note names. Some of the comments made in the middle and late sessions follow.

M. What's that?

R. B.

M. So that means D must be there, right?

R. Right.

M. Let's see, I want a lower sound... down here I guess, that...that must be C.

Session 4, Subject 2

R. I'd like to do one more part, like the second one with gap 4000, but instead of C, I'd like to use E.

M. That's a C chord note too.

Session 4, Subject 2

As with note durations, it appeared that the relative sense developed persisted even after note names were learned.

M. It's supposed to change - go up in a while...like then go up one higher.

R. An octave higher?

M. No, less than that.

Session 10, Subject 2

The learning of note names and durations was less apparent for Subject 1, largely because of his familiarity with many of the note names and durations referred to during the program. In the first session, he already recognized the whole, half, quarter and eighth notes. Thus, his questions regarding note names and durations or rhythm were often on a different level than for Subject 2:

Z. Can we load March of the Womp Rats?

R. Why?

Z. I want to see what the beat was. It was 2/4, wasn't it?

...

Z. It's a 4/4 beat - hah. Almost the same, isn't it?

Session 9, Subject 1

Fundamentals of Harmony. Harmony and counterpoint can be regarded as more specialized forms of music theory. Again the teaching and learning that appeared to take place in this branch of music were not planned specifically as part of the program. Understandably, the learning of harmony was not a result of major importance, but nevertheless is of interest, particularly for future program development.

The subjects were more evenly matched with respect to knowledge on principles of harmony and counterpoint as their understanding in these areas was limited. Both had a sense of the concepts of melody and harmony at the outset.

The round proved to be an invaluable vehicle for introducing elementary notions of harmony. This was especially true for Subject 1. After writing a round he found, much to his surprise, that a totally unexpected result occurred, a composition filled with dissonances. Eventually, an examination of the "bad round" and of several rounds that "work", led to the subject's understanding of the basic rule in writing a round: namely, to primarily make use of notes belonging to the tonic chord. Subject 1 proceeded to revise a round that he had written in accordance with his discovery. Some of the relevant transcript excerpts from Subject 1's experience follow:

Z. Can we do "Twinkle, Twinkle Little Star" like a round?

R. We can try it, sure.

...

Z. Oh,...it sounds awful.

R. I wonder why. Do you know?

Z. Maybe we should do more rests.

R. O.K., let's try it with, um, two then. (used two whole rests between starting points instead of one)

...

Z. Oh, it's still awful. I don't think this should be a round.

Session 5, Subject 1

R. Let's load "Row", because it's a round that works. If we look at each of the bars of music, we might find a pattern. O.K., Z___, what are the notes of C chord? Do you know?

Z. Yeah, that's easy...C, E, G.

R. Right on. Can you fill in what the chord is for each of the four bars?

...

R. O.K., let's have a look at Twinkle. Look at the chords in Twinkle.

...

R. Can you do the same thing now for another round? What's another good one?

Z. "John".

R. All right, let's load it.

...

Z. (after the fourth chord) Oh, they're all going to be C.

R. How do you know? What is it that you have for rounds that work?

Z. All one chord.

...

R. Let's look at your round.

...

R. Are there any notes that you might like to change here?

Z. Yeah, let's change that long F to E.

Session 6, Subject 1

There were several instances where it seemed appropriate to introduce or develop the manner in which leading notes generally resolve to the tonic note. While manipulating tune blocks in the eighth session, Subject 2 eventually modified a block so that the leading note would resolve to the tonic. Once this was done, a description of leading notes was given to the subject.

M. (after hearing "7448", where the leading

note rose to the mediant) I like that how it is...maybe I should hear it one more time.

...

M. Could you put that there? (changed mediant note to tonic)

...(played 7448B)

M. That's much better.

...(explained about leading notes)

Session 8, Subject 2

Another musical convention that was introduced to the subjects relates more to counterpoint than to harmony. Typically, parts moving in contrary motion on the whole, provide a more pleasing sound than voices moving in the same direction. Because of the ALF visual display, it was possible to illustrate with ease the directior of each part or voice. A comparison between similar and contrary motion was convenient, as the music could be "seen" and heard contemporaneously.

R. This time I'd like you to listen for notes moving together and crossing over.

M. O.K.

...

M. When they move apart it sounds best, doesn't it?

R. Usually, M___.

Session 5, Subject 2

Another observation relating to harmony was made by Subject 1 while listening to "Swingin in the Country" and observing the visual display:

Z. It's like our other good ones. All in one chord - no different chords. When one thing changes, they all change...Look at that! Like they're juggling.

Session 9, Subject 1

Composition. The activity that proportionally accounted for most of the time spent on the program for both subjects was composition. Without exception, in each of the sessions the subjects either worked on original compositions or transcribed known compositions. This was, partly due to the structure of the sessions. In addition, though, the enthusiasm on the part of the subjects also accounted for much of the

music that was composed. The enjoyment of the subjects was evidenced in a number of ways. For one, the subjects were eager to begin composing very soon after arriving for most of the sessions. Secondly, the subjects were eager and proud to have others hear their compositions.

Z. Listen to what I did, Dad.
.....PLAY Round
Z. Is it good Dad? Do you think it's good?

T. Yes. Yes, it's very good, Z___.

Session 4, Subject 1

M. Mum, I want to play some stuff for you, O.K., some stuff that I wrote.

J. Sure.

Session 5, Subject 2

Another indication of the enjoyment and interest in the writing of music was that on several occasions, the subjects came to the sessions with an idea for a composition or with a question or prediction about something they had already written. Excerpts to illustrate include the following:

Z. Can we load "Go Tell" and compare it with the music I brought to see if we did the right thing?
.....
R. Do you see any differences?

Z. Yeah, we started lower.

Session 8, Subject 1

R. I'd like you to try two things today. First of all, I'd like you to write another round, and...

M. I've got a good tune.

R. .....and I'd like you to try notes at different speeds, like some notes faster, and some slower ones, instead of using mostly quarters.

M. Yeah, ...I've got a tune with different speeds in it. It's got A, C, D, E, E, E, F, D, C, A. Hey, can we call it ACE?

It's got all those notes in it. I want to write another round, that goes again and again and again.

Session 3, Subject 1

The interest in composing is undoubtedly best encapsulated by a simple statement mady by one of the subjects at a dinner conversation at home one evening between the third and fourth sessions. He stated:

Z. Oh, I just love to go to R___'s. It's just so much fun composing.

Active Participation. The incidents illustrating the active interest taken by both subjects in the program are numerous. Even a cursory examination of almost any section of the original transcripts points to the active nature of the enterprise. Interest was obvious in the sessions themselves, as subjects were consistently attentive in sessions which often ran for close to an hour and a half, and never ran less than an hour. The interest was sustained even when the instructor left the room for periods ranging from 10 to 40 minutes.

The results for this section are divided into three parts. The first part deals with comments made, mostly by the subjects, in the sessions themselves. Secondly, the potential and actual transfer to other musical activities as indicated by the subjects, is considered. Finally, the general interest, as evidenced by comments and occurrences outside of the program itself, is highlighted.

(a) The Sessions

Subjects frequently asked why certain types of compositions sounded as they did, often predicting results before hearing a given composition. The subjects went so far as to encourage this kind of thinking from their family and friends.

M. You got a tie. Do you know why?

...

A. Now, press it five times.

M. Let him do what he wants. Do you want a rest? You go like this.

...

M. Now, put rests in.

R. Who's writing this part, M___?

M. P___. Now try the highest note, this one

here, press this...now you're done.
...

M. No, don't do that, think about the other parts.

Session 6, Subject 2

In addition, subjects were active when composing, usually pursuing a writing activity until they were pleased with the result.

Z. Hey, that's like a round. Can we do one of those?

Session 2, Subject 1

R. What would you like to do first?

M. Write a song...no, I want to hear "Four Lines", the one we wrote.

Session 2, Subject 2

R. Nice.

M. Nice? You call that nice? It needs more parts.

Session 5, Subject 2

Z. I know what kind of sound I want. One of them's in "John".
...LOAD John/located part by listening and watching visual display
...

Z. Oh, it's got a long gap.

Session 7, Subject 1

As well, subjects were confident and involved enough to choose to disregard advice given by the instructor with respect to their compositions.

R. What key would you like to write it in?

Z. C.

R. C for sure? How about a different key?

Z. No, C. You said I could choose any key.

Session 10, Subject 1

R. I think the melody should be softer.

M. No, make these softer. (accompaniments)

R. How about 50000?

M. No, 30000.

Session 9, Subject 2

One of the results that is related more to the delivery system, i.e. ALF, than to music generally is also indicative of the subjects' active role. While the attention of the subjects was occasionally directed towards the visual display, specific instruction regarding the display was not intended. However, comments made by the subjects in later sessions as compared with those from earlier sessions seem to indicate that the subjects were not merely passive observers of a colourful display.

Early:

M. Huh! Those lines are kinda neat.

Session 1, Subject 2

R. ...What did you see?

Z. Well, there were colours and lines.

R. What did the lines tell you?

Z. They were blue.

R. What happened on the lines?

Z. They were different speeds.

Session 1, Subject 1

Later:

Z. See, there's a chord.

Session 2, Subject 1

R. What did you see when you were listening?

Z. Oh, the usual. Two parts and the melodies moving.

Session 3, Subject 1

The attention of the subjects to the ALF music was evident in

some of the listening activities as well. The most striking example comes from Subject 1's remarks when the recording of the second movement of Haydn's Symphony No. 94 (The Surprise Symphony) was played for him. One suspects that his highly cognitive responses and obvious enthusiasm towards the recording would not have been as great or as meaningful had he not had the exposure to the ALF version. This contention is supported by the kinds of comments made after playing a recording of part of another symphony composed in the same period was played. Some excerpts follow:

R. I'm going to play something for you that I think you'll recognize, Z___. I'd like you to tell me what you think of it, O.K.?

Z. Oh, they're more pure sounds. I think it's trying to show off.

R. What's showing off?

Z. The computer.

Z. Oh...that's some surprise.

Z. There are basses in there.

Z. Yeah, they're more pure sounds than the computer.

Z. It's slower.

Z. Violins, right?

...

Z. Oboes, I hear oboes...drums.

Z. Little drums, I think.

Z. Haydn was quite famous.

Z. The time is even, 1...2...3...4.

...

Z. There's going to be another surprise.

R. Which one do you like better, Z___?

Z. The record. The tone was different from the computer...but I like them both.

R. What do you like about the computer one?

Z. Well, I don't know, it's just more

modern.

R. I'm going to play the computer one now. Tell me what you think about it now. ...PLAY Symphony #94

Z. The computer is pretty loud all the time, isn't it?

R. Do you like it better faster or slower?

Z. Slower. I think it's (computer) trying to show us what it can do.

Z. This is supposed to be soft, but instead they (the computer version) do it higher.

R. Is there anything else you can think of?

Z. Yeah,...the other one (computer) is... like...more artificial. Well, it is artificial, not like the record.

Session 5, Subject 1

Z. I like this one (Mozart's Jupiter Symphony, KV 551) better (than previous selection, Bach's Toccata and Fugue in D minor for organ).

R. What would it look like on ALF?

Z. A little thing at the top would go...di di di di di di.

R. Is it like anything else you've heard?

Z. It's kind of like the Surprise Symphony, isn't it? Because it goes soft and then comes loud again and they've got a flute and it kind of does the same solo parts. And there's violins.

(b) Extensions and Transfers

Often the subjects related the experiences of the instructional program to their other musical activities, or proposed ways in which their ALF experiences could be translated into other forms. Comments were made during the sessions, at home and at school.

One of the extensions that occurred for Subject 1 resulted from the ALF version of the Surprise Symphony. This special interest was obvious already in the second session:

Z. Who wrote this?

R. Haydn.

Z. Who's he?
...explained when he lived, asked what Haydn might think of ALF.

Z. I don't know. He sure would be surprised by the computer. (Subject 1 listed other things in the room that Haydn would be surprised by, eg. walls, ceiling, floor metal framed chairs, tables, chalkboard, etc.)

Z. That's pretty good for way back then.

Session 2, Subject 1

Almost a month after the second session, Subject 1 asked his parents for a record with the Symphony #94 on it, and about Haydn's life. Two weeks after this, he spoke to his piano teacher about the Surprise Symphony, and a few days later, asked for a book on Haydn's life.

Both subjects seemed to see the potential for extending what they had learned about music and composition to instrumentation, as indicated:

R. Here, M___, I've got something for you (music for "Und").

M. Oh, maybe I could play it on the piano someday.

Session 6, Subject 2

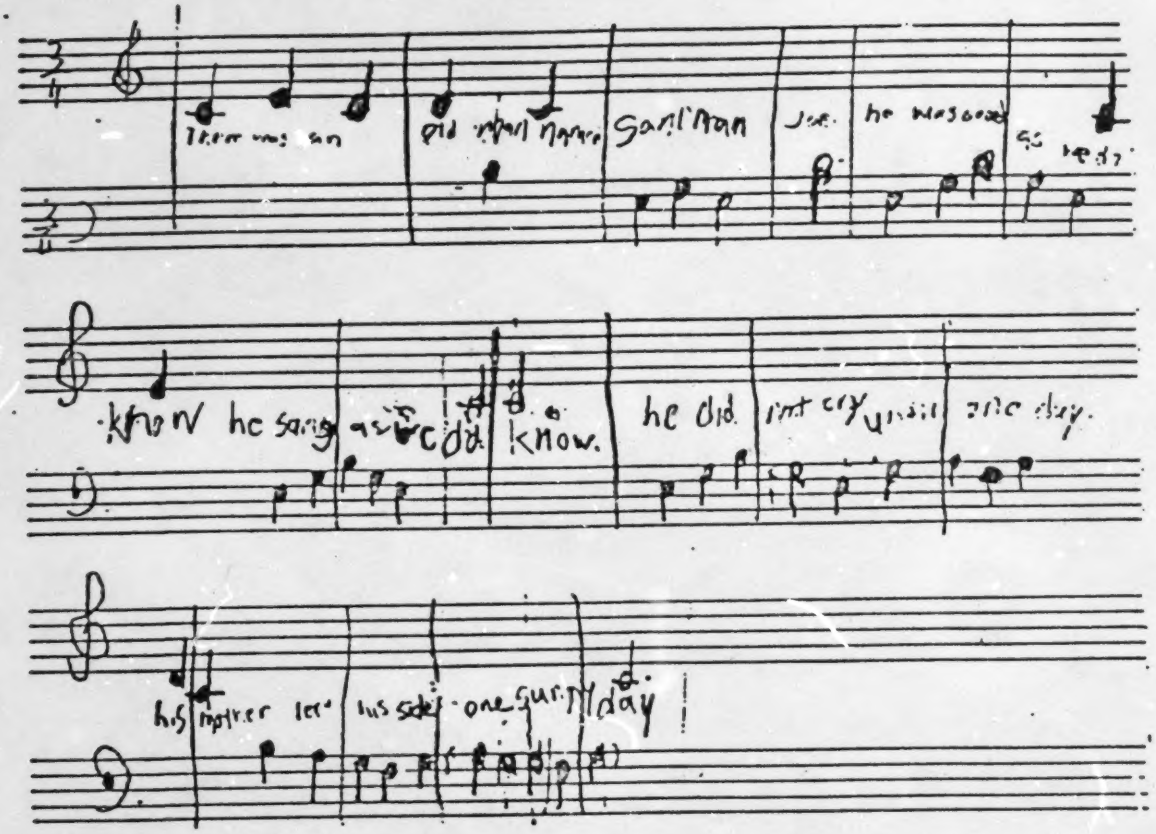
M. (after "March of the Womp Rats") We've probably got all the instruments at our school that could do this.

Session 10, Subject 2

Several months after the program had been completed, Subject 2 was composing music on paper and at the piano keyboard. Some of his comments since the program was completed indicate that he views himself as capable of composition, just as he views himself as capable of constructing a sentence or a paragraph! In one case, he proudly produced a song that he had composed on manuscript paper (see Figure 2). In another case, a composition (in C minor) was played by Subject 2 at a piano lesson, three months after the program had ended.

Figure Caption

Figure 2. Sandman - Subject 2



(c) General Interest

The motivation and interest that the subjects and others had for the ALF-based program was frequently evidenced by statements and actions to that effect. Note the following comments:

R. ...Well, we've still got a couple of minutes.

Z. Only a couple of minutes? Aw...

Session 5, Subject 1

M. Oh, it's only 3:30. It's another hour 'til ALF,...well, not really. 'Cause we can leave in 45 minutes.

just prior to
Session 4, Subject 2

R. Well, that's it, M___.

M. Well, yeah, but not really, because you said I could come back in January.

Session 10, Subject 2

And perhaps the most rewarding comment of all:

J. Did you work hard? R___says you had a good session.

M. Oh no...it's never hard work. It's fun.

just after
Session 5, Subject 2

Task Evaluation. Predictably, some of the tasks proved to be more useful and challenging to the subjects than others. The intent of this section is to simply summarize the positive and negative characteristics of each of the tasks.

(a) Composing Activities

The random music, round, adding harmony and open writing exercises were the most successful, both in terms of teaching and interest on the part of the students. The random music served the expected purposes without much variation, as it proved to be useful for familiarizing the subjects and their family and friends with the ALF system, and in motivating the participants to learn about composition. The round was even more successful than anticipated, as

besides fulfilling the expected purposes, the round and subroutine principles and commands were used throughout the program, for writing and teaching/learning, often on the subjects' own initiative. Adding a harmony line was enjoyed by both subjects. It was sensed that the subjects felt an extra degree of accomplishment and confidence after completing this task, presumably because they had successfully added a part to create a composition that sounded much like music that they were accustomed to. The open writing activity was also useful, but in different ways for each of the subjects. One subject, through the open writing exercise, indicated his strong preference for traditional structure, while the other subject saw the exercise as giving him an opportunity to experiment with many of the sounds that he had found stimulating during the sessions.

Writing a known song was apparently more enjoyable for one subject than for the other. Not surprisingly, the subject that enjoyed this task the most was keenly interested in translating known songs for ALF throughout the sessions, and had asked to write a known song before the instructor had suggested it.

The least successful writing activity was the Variations on a Theme. Both subjects seemed somewhat less interested in this activity than in the others. It was sensed that the subjects did not quite comprehend the significance of this task, and thus, seemed to perform it primarily because it was asked of them. However, it is possible that the instruction or approach was one of the reasons that the task was somewhat unsuccessful, and thus, the task itself may still prove to be a useful one in other settings.

(b) Related Activities

The most worthwhile related activity was the listening exercise which required the subjects to compare an ALF version of a classical composition with the classical work as it was originally intended to be performed. Through this listening activity, the effects of the ALF visual display on the subjects' auditory perception of the work was highlighted. In addition, this and other listening activities gave the subjects a chance to compare the ALF medium with other music media.

The tune blocks exercise was not as successful as anticipated on

the basis of prior research. The subjects were not eager to perform this activity, although once they began developing the tune blocks, they seemed to become more involved and interested. Some useful teaching occurred through the tune blocks in one case, where the leading note concept was reinforced.

The Individual Subjects

It is probably apparent that on several issues the experiences of the subjects were strikingly similar. On other aspects, however, they were remarkably different. This is to be expected, for the subjects were substantially different with respect to personality, musical training, musical diet and general academic achievement. As well the subjects were observed in a context where individual differences would be underscored. It is these differences that will now be addressed.

Subject 1. Subject 1 tended to be cautious in his approach to the activities and to music in general. He was most comfortable with writing activities that were based on known works, or, if an original composition was being written, if the original work was in a familiar key. These observations are supported by the following interchanges:

R. Well, let's write something to go with it (with the melody for "Mary Had a Little Lamb")

Z. Oh, no, no.

R. I'm not going to lose yours!

Z. If you wreck that, I'll be so mad.

Session 1, Subject 1

Z. ...There's a song on the piano with one. It's called, um, Go Tell Aunt Rhodie.

R. Well, let's do that. How does it go?

Session 2, Subject 1

The cautious approach adopted by Subject 1 can be illustrated further by an examination of his general concept of music. Subject 1 had firm notions regarding "right" and "wrong" sounds, both with respect to his compositions and those of others. This tendency to regard music against a fixed standard, as either "good" or "bad", "right" or "wrong", decreased as the sessions progressed. Indeed, in

an ALF session with the other subject a couple of months after completing the program, Subject 1 seemed to have a broader and more tolerant view to music, as indicated by his approval of random music (Four Lines and Down).

Z. What's Arms Across the Water?

R. Why don't you play it and find out?
...PLAY Arms Across the Water
R. What do you think of that one?

Z. I don't think it was very good. Who wrote that?

R. A friend of mine.

Z. Does she know anything about music?

R. Lots!

Z. Why didn't she write it properly then?

Session 3, Subject 1

Z. Oh,...it doesn't go right...Oh, it doesn't fit...can you play it the right way?

Session 5, Subject 1

Z. P-L-A-Y...Down...speed 100...Huh, wierd...(giggles)...Hey, that's good.
...
PLAY Four Lines
Z. (lots of giggles!) Hey, that's good.

Joint Session
(after all formal sessions were completed)

Subject 1 appeared to be extremely skilled in terms of pitch, harmony and rhythm sensitivity. This was observed when he was translating a known work into the ALF music system. There were very few times in which he failed to locate, on the first attempt, a note that he was looking for. Once Subject 1 became aware of the significance of the durations of the notes to the rhythm of a work, he was careful and accurate in choosing the correct note values.

Subject 1 seemed to thrive on the listening activities. In particular, his interest in the second movement of Haydn's Symphony No. 94 (The Surprise Symphony) was substantial. This interest was

sufficient to motivate him to ask questions about Haydn and to share his enjoyment of the music recording with other members of his family.

Subject 2. In contrast to Subject 1, Subject 2 had a less fixed outlook towards music. He was consequently less inhibited in his writing, and was more accepting of nontraditional forms and sounds. Thus, while he noted that some music was not what he was accustomed to hearing, he nevertheless seemed somewhat intrigued by much of it, examining each work on its particular merits. As well, Subject 2 was willing to try writing original works in a variety of keys, often in a minor mode. Subject 2 also preferred to write his own compositions to known works, in fact, the only known work he entered on the ALF system was during the first session, on the request of the instructor.

Subject 2 had some difficulty with pitch and rhythm, as was evidenced in his attempt to translate a known work, when working with tune blocks, and occasionally, when attempting to create a particular passage for an original composition.

The listening activities were not particularly inspiring for Subject 2. While he made some comments, especially with respect to the Haydn, that would indicate that his understanding and appreciation of the work was increased due to the ALF exposure, it appeared that he was not taken by the listening activity, and indeed, seemed eager to proceed to an activity where he could write music.

Summary of Results

Despite the different areas of emphasis and orientation of the two subjects, both subjects seemed to thoroughly enjoy the ALF program. By focussing on the performances of the subjects individually and together, it can be seen that the main effect of the ALF program was that composition became an exciting and realistic process for the subjects. They were challenged and delighted by the compositional activities, despite their individual differences. As well, the related activities were successfully tied to the program so as to capitalize on the unique medium that the ALF synthesizer offers. Further, even though the subjects had different musical backgrounds, personalities, and interests, the program could accomodate individual strengths, while at the same time leading to similar general outcomes. Finally, it would seem from the sessions themselves and on the basis

of related statements on the part of the subjects, that the program broadened the subjects' interest and view of music as a whole.

Discussion

It seems clear that a microcomputer music environment can provide meaningful musical experiences for children. In such a situation, students evidence a high degree of active involvement which seems to contribute substantially to the depth of their learning experiences. Often students are involved in the kind of thinking that Papert (1980) and Bamberger (1973) claim is desirable in a computer-assisted approach to learning.

Microworld Opportunities

There are a number of opportunities that can be provided by the ALF system that, although possible without the assistance of a computer-based music program, are probably more likely to occur with a computer-based program than without. First, students are given immediate and accurate feedback regarding their expression of musical ideas. Second, because the physical skill needed to play an instrument is not required, the students can predict and test ideas that might otherwise be too complicated for their skill level. The commands and operations needed to operate the ALF system are easily grasped by students. Third, the ALF system can be used to record all of the students' work, which can be retrieved for listening or editing at any time. Fourth, the ALF system provides a worthwhile tool for musical composition. While there is no doubt that children can compose without the aid of a computer, it seems that most students do not think of composition as an activity which they could enjoy, largely because composition as such is not a skill that is widely taught or encouraged in our musical culture. Finally, and perhaps most importantly, the ALF system encourages children to reason and experiment with musical ideas, sounds and problems, an approach that is rarely exercised in other forms of music teaching (Slind, 1971). The types of structural relationships highlighted by both the LOGO and ALF music systems are simply not stressed in music teaching, at least until the student reaches a relatively advanced level of music study, usually in private lessons. In the same vein, musical problems are rarely advanced, rather, musical concepts are misrepresented as clear-cut, irrefutable

principles. Therefore it is not surprising that composition challenges are rarely issued, and almost certainly not to students of the primary or junior level.

Due to the use of standard musical notation in the ALF system, teaching of music fundamentals as it relates to composition and analysis is appropriate. Of course, music fundamentals can be taught without computers. But unlike typical instruction for music theory, in the ALF environment music fundamentals can be taught in the context of a compositional activity, often at the request of the student, rather than through a more traditional drill and practice format. It was indicated that an ALF approach could serve as incentive for students to learn the music fundamentals, and to strengthen the students' understanding of music theory.

Understandably, the level of computer literacy reached by students is increased as a result of contact with ALF. This is evidenced in part by the ease with which students come to execute the various commands, as well as by their increased interest in other computer languages and systems.

Program and System Limitations

Despite the success of the ALF music setting, one cannot help but acknowledge several limitations.

Although the typing commands are minimal as games paddles are used for much of the entry, very young children cannot profitably use the system unless someone is available to help with the commands. This is one of the drawbacks which is overcome by the Musicland system (Lamb, 1981), which bypasses the use of the keyboard interface.

As well, student characteristics shape and limit the learning. On the basis of the case study research, it seems clear that while the ALF environment can alter the preconceived musical notions of students, the views that children bring into the situation are important. In particular, the musical training and diet for any given student can affect results considerably. It is to the credit of the ALF microworld, however, that individual differences can be accomodated.

Teacher characteristics are also critical. The success or failure of an ALF or similar microcomputer based approach to music

depends significantly on the teaching skills and musical background of the instructor. As Beckwith (1975) and Bamberger (1973) rightly argue, students should be exposed to other forms of musical experience besides the computer. Thus, the role of the teacher in broadening the musical environment in this way is also of paramount importance. The teacher must recognize what kinds of appropriate related activities can be provided and guide participation in such pursuits.

Microcomputers in the Macromusic World

One is drawn to the conclusion that computer-assisted music instruction can be an appropriate way to inspire fulfilling musical perceptions. But it should also be evident that, as has been stated, computer-assisted music instruction alone cannot result in a comprehensive appreciation of music.

As with any curriculum innovation, teachers are aware that panaceas for learning are unlikely regardless of the benefits of the particular new approach. There is a danger inherent in overextending the computer music approach beyond the microworlds to which it is best applied. Computer-assisted music instruction should be used only after considering what kinds of musical experiences children should be exposed to, and whether the same kind of learning could occur more effectively in another way.

Teachers can take advantage of the computer music microworld in at least three significant ways. First, microcomputers themselves can be used to deliver the existing music curriculum in a less restrictive and more efficient manner. By making use of the accurate computer records, teachers can use micros to deliver a more consistent music program where consistency is desired (eg. with the teaching of music theory,. However, while this may be a useful application of micros it is the least imaginative.

More exciting is the potential to use microcomputers to present music in a more personal, individualized manner. But this will not occur without appropriate direction on the part of the teacher, and accompanying freedom on the part of the learner. Like gold found in its raw and natural state, the wealth of the microcomputer music world lies in its potential applications, both practical and aesthetic. The skill of the teacher is vital in refining the potential accomplish-

ments of the learners.

The third way in which the microcomputer world can be used to positively influence music teaching is an outgrowth of the second. While microcomputers can provide a mode of individual expression in familiar forms, the microcomputer perspective may also serve as a basis for evaluating and redefining the current music curriculum and the concommitant ways in which we view the learning process. It may be that through this new perspective, teachers may determine what can and should be taught which is not currently taught. Or, microcomputers may illustrate ways in which what is now taught could be taught more effectively. Further, micros may illuminate areas in which music may be successfully integrated with the other curricula and how such integration might reflect on the global notions of musical cognition and general mental processes. The possibility of using the LOGO music approach in conjunction with mathematics, the humanities and special education has been raised by Beckwith (1975). More generally, the computer-based approaches (ALF/LOGO/Musicland) which facilitate learner-directed involvement are valuable insofar as they may shed light on symbolic processes and mental development (Papert, 1980).

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ABSTRACT

The possibility of using the ALF music editor for computer-assisted instruction in composition was examined. Two boys, aged 8 and 10 years, served as subjects. Naturalistic observations were made as they participated in a 10-session program. The program consisted of composition activities, such as adding harmony and writing rounds, as well as related activities, including listening tasks. Both subjects displayed a keen and active interest in the program. Most of the composition activities, particularly the round or canon, were found to be useful vehicles for teaching both composition and related topics, such as music fundamentals. There were some differences in the nature of the subjects' compositions as well as in their approaches to the tasks themselves. One subject preferred a traditional orientation to the ALF program, while the other subject had less conservative musical preferences. The program was suitable for accomodating these individual differences. Moreover, the interest displayed by both subjects extended beyond the actual sessions themselves. It was concluded that the ALF music system could be potentially used to great advantage in initiating interest in composition, at least on an individual basis. It was noted that the role of the teacher was critical, and the possibility of adding teaching programs to the software was suggested for future work. Other research suggestions included testing the program with larger groups with appropriate modifications and to develop a set of activities whereby the learning and interest generated through the ALF exposure could be transferred to other musical experiences.